Impaired Water Identification Rule

Stakeholder Meeting #3

August 26, 2004

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Meeting Topics

Purpose of today's meeting:

- Address comments regarding assessments based on *Escherichia coli* and chronic Aquatic and Wildlife standards.
- Introduce proposed changes to these assessment methods.

Stakeholder meeting info is available at:
www.az.deq.gov/environ/water/assessment/index.html

Next meetings:

Draft rule meeting 1	Week of Sept. 13th
Draft rule meeting 2	Week of Sept. 27th

Chronic Aquatic and Wildlife Standards

- Chronic A&W standards are established to protect aquatic life and wildlife from long-term exposures to toxic pollutants.
  - Criteria are based on a 96-hour (4-day) exposure.

- Acute A&W standards are established to protect aquatic and wildlife from short-term exposures to toxic pollutants.
  - Criteria are based on a 1 hour exposure.

Chronic Aquatic and Wildlife Standards

- How to assess?
  - IWIR is ambiguous – Does it apply to grab sample?

  - Impaired Water Identification Rule (IWIR)
    - Impaired = > 1 exceedance.

  - Preamble to the IWIR indicated a <u>4-day mean</u> chronic criteria would be used; however,
    - Arizona's 4-day mean standard was replaced (2002)
    - Cannot calculate the chronic (or acute) standard for many metals and ammonia when a mean of the results is used because the standard is dependent on hardness, pH, or temperature <u>at time sample was collected</u>. (example)

Example: Standard Varying by Hardness

Date	Result (µg/L)	Hardness (mg/L)	Calculated Standard	Assessment
6/25/01	31	620*	29.28	
7/1/01	29	200	16.19	
8/4/01	31	430*	29.28	
7/1/04	19	250	19.59	
8/12/04	25	312	23.68	
9/15/04	25	380	28.02	

Can calculate a mean of the results.

Mean of the hardness values is not relevant because standard is based on hardness <u>at the time it is sampled</u>. So what would the standard be?

Problem exists with several metals (hardness) and ammonia (pH and temp).

(* Use hardness at 400 if hardness is >400.)

Chronic Aquatic and Wildlife Standards

- ## How to assess?
  - Revised surface water standards (2002) indicate that "compliance" with chronic A&W criteria is determined from the geometric mean of last 4 samples taken at least 24 hours apart.

    - Assessments are not a determination of compliance, but should methods be related?

    - The "last 4 samples" cannot be used to determine whether the geometric mean is exceeded more than once as required in IWIR. (How take last 4 samples twice?)

    - Problem exists with hardness, pH, or temperature dependent standards when taking the geometric mean.

Chronic Aquatic and Wildlife Standards

- Main issue:
  - Can a grab sample be used to represent a standard based on a 4-day mean?
    - What assumptions are being made?
    - What supporting evidence is needed?
    - When would these assumptions not be supported?

  - What does EPA guidance indicate?

  - What are other states doing?

Chronic Aquatic and Wildlife Standards

EPA CALM Guidance

- Guidance to states on how to do assessments and impaired waters identification, recognizing limited resources.

EPA 2004 Assessment Guidance

- Guidance and instructions to states on how to do assessments and what to submit.

- Impaired if acute or chronic A&W criteria for toxics are exceeded more than once in a 3-year period.
  - Ambiguous as to whether dealing with grab samples or 4-day average exceedance.
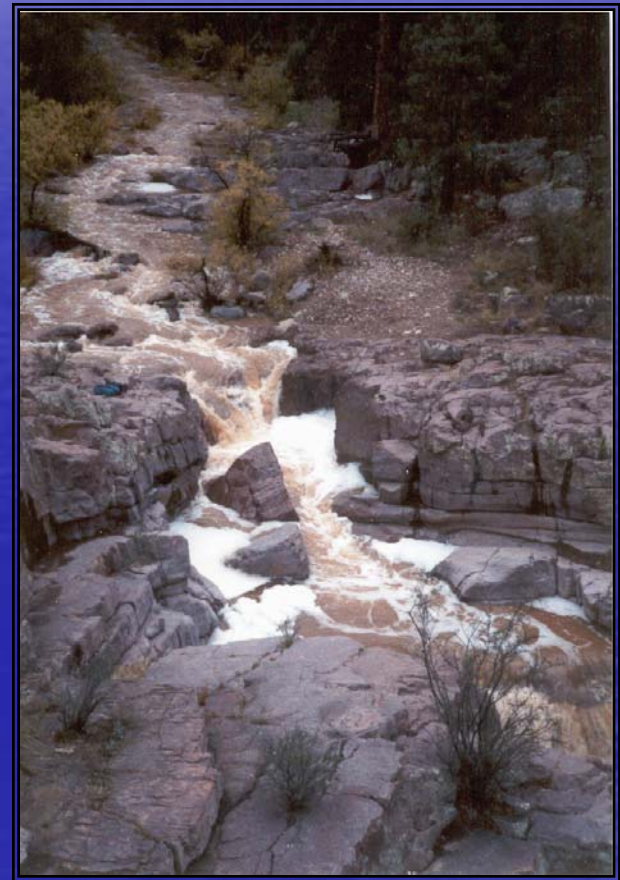
Chronic Aquatic and Wildlife Standards

EPA Technical Support Document (1991)

– Excursions no more often than once in 3-years. An ecosystem should be able to recover that often from a <u>marginal</u> criterion excursion.

– Recovery periods may be longer than 3 years if:
  • Multiple minor excursions (frequency),
  • A single major excursion (magnitude),
  • Affected area is large (extent),
  • Persistence of the pollutant (duration).

– As continuous monitoring in the receiving water is not feasible in most cases, use a statistically designed monitoring program to minimize the chance of missing an exceedance.

Chronic Aquatic and Wildlife Standards

Summary of issues to consider when using grab samples to assess chronic criteria:

- Frequency of the exceedances,
- Magnitude of the exceedance,
- Extent of the contamination area, and
- Duration of the exceedances.

Chronic Aquatic and Wildlife Standards

- ## What are other states doing?
  - ### Out of 24 states:
    - #### 6 were not using chronic standards
      - 5 based A&W assessments on bioassessments
      - 1 based A&W assessments on WET
    - #### 18 using chronic standards to assess A&W
      - 1 required 4-day average (no data available, so not able to assess chronic criteria)
      - 17 used grab samples.

Most states are using grab samples to represent a 4-day mean and assess chronic standards.

Chronic Aquatic and Wildlife Standards

- **How do other states assess impairment?**
  - Of the 17 using grab samples for chronic criteria:
    - 5 states -- >1 exceedance in 3 years
    - 1 state -- >2 exceedances in 3 years
    - 6 states -- >10% exceed
    - 2 states -- >10% exceed at a specified confidence level
    - 1 state -- >50% of samples exceeded
    - 1 state -- Annual mean exceeded
    - 1 state – 85th Percentile of samples exceeded

Most states (13 of 17) are either using:
  - >1 exceedance in a 3-year period, or
  - >10% / >10% at a confidence level.

Chronic Aquatic and Wildlife Standards

- Propose assessing chronic criteria using:

  – Modified binomial approach (>10% exceedance at 95% confidence level),
    - Frequency of exceedances,

  – Plus specific supporting evidence:
    - Magnitude of exceedances,
    - Duration of exceedances, and
    - Extent of the contamination area.

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Chronic Aquatic and Wildlife Standards

Step 1. Impaired due to acute standards.

– If a parameter of concern is assessed as impaired due to acute standards, an assessment of chronic criteria will not be pursued.
  - The TMDL must address both acute and chronic criteria.
  - Impaired, based on acute exceedances, is:
    >1 exceedance in 3-year period.

– If parameter is not impaired due to an acute criterion, and a chronic criterion is being exceeded, go to Step 2.

Chronic Aquatic and Wildlife Standards

Step 2. Frequency of exceedance -- Assess using modified binomial approach

- Impaired –
  - >10% samples are exceeding standards at a 95% confidence level (over 3 or more sampling events).
  - Minimum sample size is 10, unless sufficient exceedances have occurred.
- Attaining –
  - 10% or fewer samples are exceeding standards at an 85% confidence level (over 3 or more sampling events).
  - Minimum sample size is 10.

Chronic Aquatic and Wildlife Standards

Step 2. Frequency of exceedance

- If binomial indicates impairment, go to Step 3.

- If binomial does not indicate impairment, stop assessment of this chronic criterion.
  - Assess as attaining if 10% or fewer exceeding at 85% confidence level
  - Assess as inconclusive if insufficient data to determine attaining or impaired.

Chronic Aquatic and Wildlife Standards

Step 3. Magnitude of exceedance – Use a screening value (50% larger than the standard).

– Multiply standard times 1.5.

– Determine exceedances of the screening values.

– Recalculate the binomial, counting as exceedances only those samples that exceed the screening value

- If using screening value exceedances, the binomial still indicates impairment, list as impaired.

- If using screening value exceedances, the binomial does not indicate impairment, go to Step 4.

Chronic Aquatic and Wildlife Standards

Step 4. Duration of exceedances

- Determine if exceedances are sporadic or occur during consecutive monitoring events.
  - Consecutive exceedances provide supporting evidence that exceedances are occurring over a longer period of time or repeatedly.
  - Exceedances must be more than 7 days apart

- If exceedances occurred during consecutive sampling events, list as impaired.

- If exceedances were sporadic (not occurring during consecutive sampling events), go to Step 5.

Chronic Aquatic and Wildlife Standards

Step 5. Extent of exceedances

- Review existing data to determine whether exceedances are also occurring in upstream or downstream reaches.

- Determine if a likely source is impairing this larger area by reviewing GIS coverages of land uses and discharges, and by talking to monitoring staff and others familiar with discharges in the drainage area.

- **If upstream or downstream reaches are impaired and a common source if likely, list as impaired.**

- If upstream or downstream reaches are not impaired, stop assessment of this chronic criteria.
  - Assess as inconclusive.

Chronic Aquatic and Wildlife Standards

- **Proposal for assessing chronic criteria**
  - Step 1. Acute criteria -- If being listed due to acute criteria stop. Otherwise, if any chronic criteria are exceeded, go to step 2.

  - Step 2. Frequency -- If binomial indicates impairment, go to Step 3.

  - Step 3. Magnitude – If binomial indicates impairment based on screening value exceedances, list as impaired. If not, go to Step 4.

  - Step 4. Duration – If consecutive samples exceed standards, list as impaired. If not, go to Step 5.

  - Step 5. Extent -- If upstream or downstream exceedances, and a common source is likely, list as impaired.

Chronic Aquatic and Wildlife Standards

Date	Cadmium (µg/L)	Hardness (mg/L)	Standard	Flows (cfs)
1/25/01	<5	2202	Calculated using hardness 400	0.02
2/23/01	<5	2575		0.01
3/24/01	*9**	2400		0.03
4/20/01	*8**	2292		0.03
6/23/01	*9**	2380	6.2 µg/L	0.01
8/5/02	<4	2400		0.02
10/8/02	<4	2344		0.01

Example 1.

Step 1. No acute standards were exceeded.

Step 2. *Frequency – 3 of 7 samples exceeded . Binomial = impaired.*

Step 3. Magnitude – 6.2 times 1.5 = 9.3. Screening value not exceeded.

Step 4. *Duration – 3 consecutive samples exceeding standards.*

Step 5. Extent – unknown (no upstream or downstream data).

Assessed as impaired, based on steps 2 and 4.

Chronic Aquatic and Wildlife Standards Example 2

See hand out.

- ## Summary:

  – Step 1. Not being listed as impaired due to acute copper standards.

  – Step 2. *Frequency -- 3 out of 12 samples.* **Exceeds binomial.**

  – Step 3. Magnitude -- Only one screening value was exceeded.

  – Step 4. Duration -- Exceedances are sporadic, not occurring in consecutive samples.

  – Step 5. Extent -- Unknown.

  Assessed as inconclusive, although binomial was exceeded.

Chronic Aquatic and Wildlife Standards Example 3

See hand out.

- Summary:

    - Step 1. No acute exceedances.
    - Step 2. *Frequency - 33 exceed in 41 samples. Binomial indicates impairment.*
    - Step 3. *Magnitude - Screening values exceeded in 28 of 41 samples. Binomial based on screening values indicates impairment.*
    - Step 4. *Duration – Many consecutive exceedances indicates impairment.*
    - Step 5. Extent – Unknown. Not occurring upstream. Insufficient samples to determine if contamination occurring downstream.

    Assessed as impaired, based on steps 2, 3, and 4.

Chronic Aquatic and Wildlife Standards Example 3

- **Delisting based on binomial approach:**

  – Assumes water is impaired and must show it is now attaining
    - Delist at a 95% confidence level that 10% or fewer samples are exceeding
      – Minimum of 27 samples with 0 exceedances.

  – If documented remediation actions to improve water quality, can assume water is attaining and must show it is impaired
    - Delist at 95% confidence level that >10% exceeding
      – Minimum of 10 samples with 0 exceedances

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Chronic Aquatic and Wildlife Standards

Summary of Proposal:

- Assess chronic criteria using grab samples to represent water quality conditions.

- Listings would be based on the binomial approach with specific supporting evidence to produce a preponderance of evidence that chronic criteria are being exceeded.

- Delistings would also be based on binomial approach.

Chronic Aquatic and Wildlife Standards

- **Proposal for assessing chronic criteria**
  - Step 1. If being listed due to acute criteria, chronic criteria assessment is not necessary. Otherwise, if chronic criteria are exceeded, go to Step 2.

  - Step 2. Frequency -- If binomial indicates impairment, go to Step 3.

  - Step 3. Magnitude – If binomial indicates impairment based on screening value exceedances, list as impaired.   If not, go to Step 4.

  - Step 4. Duration – If consecutive samples exceed standards, list as impaired.   If not, go to Step 5.

  - Step 5. Extent -- If upstream or downstream exceedances, and a common source is likely, list as impaired.

Escherichia coli:
Listing Criteria

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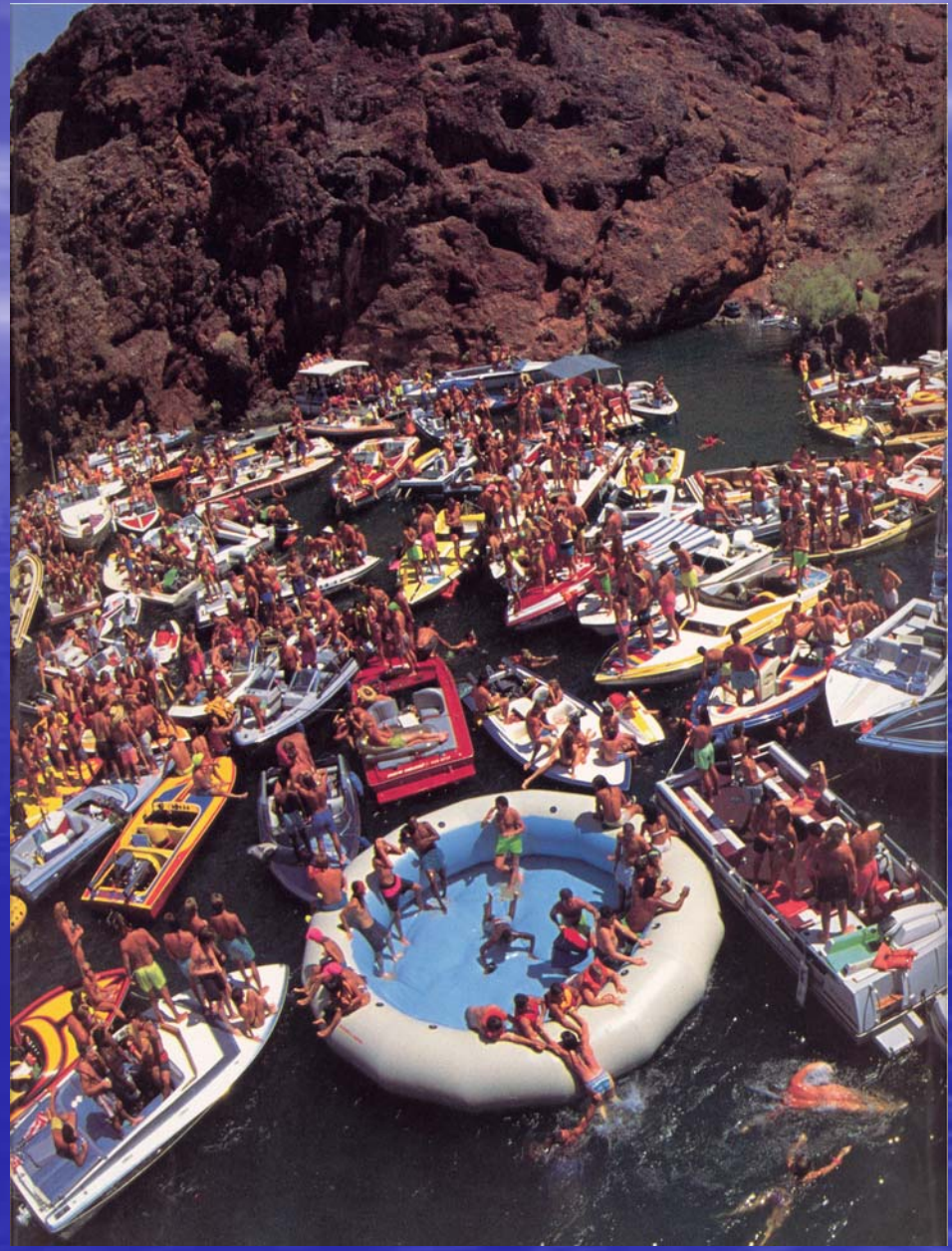
Escherichia coli: 101 Class

- **Bacterial standards:**
  - Arizona uses *Escherichia coli* as a bacterial indicator of potential fecal contamination.

  - Waters with fecal contamination can spread many types of waterborne diseases (bacterial, viral, and protozoan).

  - *E. coli* is now recognized as a more accurate indicator of potential water borne diseases than fecal coliform or total coliform -- previously used as standards.
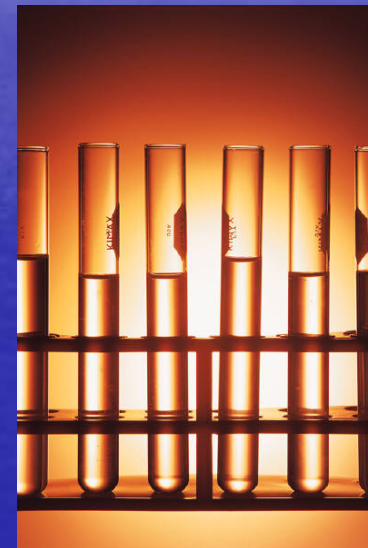
Escherichia coli: Listing Criteria

Issues to resolve:

- Is the >1 exceedance in 3 years appropriate with all types of datasets?

- *E. coli* analysis results in a "most probable number;" therefore, listing criteria need to account for a wide margin of error.

- When applying the geometric mean standard, what is the appropriate time interval (e.g., 30-day, annual swimming season, annual, all data)?

Escherichia coli: Single Sample Max

Do we always need to make a listing based on:

>1 exceedance in 3 years?

Should we look at these exceedances differently?

- 2 exceed in 400 samples
- Exceedances at separate sites
- Sporadic exceedances
- Bacterial exceedances during storm water flow

Escherichia coli: Single Sample Max

- **EPA Guidance**

  Consolidated Assessment and Listing Methods (CALM) (2002)

  – Fecal coliform

  (Many states are still using this indicator)
    - Attaining if geometric mean is met and 10% or fewer samples exceed.
    - Impaired if either geometric mean or >10% of samples exceed.

  – *Escherichia coli*

  (EPA recommends states convert to this.)
    - Attaining if geometric mean and single sample maximum are met.
    - Impaired if either geometric mean or single sample maximum is exceeded during recreational season.

Escherichia coli: Single Sample Max

- **EPA Guidance**

  Implementation Guidance for Ambient Water Quality Criteria for Bacteria – Draft November 2003

  – Where swimming and water recreation is likely, monitoring should occur on a weekly basis.

  – Waters not likely to be used for recreation can be monitored less often.

  – If only a few samples, <u>no samples</u> should exceed the single sample maximum.

  – Where sufficient samples, inferential statistics (e.g., binomial) should be used to provide the most certainty in attainment decisions.

Escherichia coli: Single Sample Max

- **Other states**

Impairment criteria

- 9 of 10 states with fecal coliform standard used >10 to 25% exceedance rate.
- 4 of 7 states with *E. coli* standard used >1 exceedance in 3 years.
  - States have recently converted to *E. coli*, but may not have changed assessment criteria.

	Fecal	E. Coli	Total
>25% Exceed	2	1	3
>20% Exceed	1	0	1
>15% Exceed	1	0	1
>10% Exceed	5	2	7
>1 Exceed	1	4	5
Total	10	7	17

Escherichia coli: Single Sample Max

- **Existing Assessment Criteria:**
  - Impaired if:
    - >1 exceedance in 3-year period.
  - Attaining if:
    - No exceedances in 3-year period, and at least 3 monitoring events.
  - Samples taken within a 7-day period are combined, taking the worst case value.

	2000	2001	2002	Assess
Lake 1	1	No samples	1	Impaired
Lake 2	0	0	0	Attaining
Lake 3	1	0	0	Inconclusive

Escherichia coli: Single Sample Max

- Proposal to vary assessment methods:

    1. At large reservoirs, consider distance between monitoring sites.

    2. At all surface waters, consider the amount of bacterial data collected during the swimming season (May through September):
        - Smaller data sets
        - Large data sets

Escherichia coli: Single Sample Max

- ## At large reservoirs:

  Consider the distance between sites when making a listing decision:

  - If a large reservoir and sites are several miles apart, assessments will be based on exceedances per site.
  - If sites are not miles apart, bacterial data are normally combined for all sites when making an assessment.

  - Impaired based on exceedances of per site.

Escherichia coli: Single Sample Max

E. coli Data at a Large Reservoir			
Dates	Site 1	Site 2	Site 3
Feb 25, 2001	*480*	158	58
May 15, 2001	No sample	*330*	*422*
Aug 8, 2001	200	230	<2
Oct 20, 2001	15	<2	<2

If a large reservoir and sites are miles apart, although 3 exceedances occurred, no site had more than one exceedance. Assess as inconclusive.

At other circumstances, it would be shown as 3 exceedances during 2 sampling events, and assessed as impaired.

Escherichia coli: Single Sample Max

- **For larger datasets:**
  - Larger datasets = approximately 1 sample per week during the swimming season.
  - Use modified binomial approach.
    - Impaired if >10% of sampling events exceed at 95% confidence level during at least 1 year.
    - Attaining if 10% or fewer sampling events exceed.
    - Samples within 7 days are combined (sampling event).
    - Assess based on exceedances <u>per site per year</u>.

  Note: In 2004, large datasets occurred at: Slide Rock State Park, Lake Havasu, Lake Powell, and the Salt River tubing area. Sites monitored weekly generally have about 50 samples per site per year.

Escherichia coli: Single Sample Max

- **Proposal for smaller datasets:**
  - Small dataset (all other datasets)
  - Use the existing assessment criteria
    - Impaired if:
      - >1 sample exceedance in 3-year monitoring period. Minimum of 2 sampling events.
    - Attaining if:
      - 0 exceedances of standards in the last 3 years of monitoring.
      - Minimum of 3 sampling events.
  - Samples taken within a 7-day period are combined.

    The majority of data will be handled this way.

Escherichia coli: Single Sample Max

Small Dataset	
Dates	E. Coli Results (CFU)
Feb 25, 2001	*480*
May 15, 2001	24
Aug 8, 2001	*760*
Oct 20, 2001	15
Assessed as impaired due to exceedances at 2 sampling events.	

Escherichia coli: Single Sample Max

Swimming Area Monitoring

	Site A 1999	Site A 2000	Site B 1999	Site B 2000
Total samples	158	184	8	4
Total samples exceeded	12	17	1	1
Sampling events (7-days apart)	47	49	8	4
Sampling events exceeded	*10*	*11*	*1*	*1*
Based on binomial – Impaired if this number of samples exceed standard.	*9*	*9*	Not apply	Not apply

Site A - Samples within 7 days were combined, using worst case result. Sampling 1/week. Assessed as impaired based on binomial.

Site B – Small dataset. Assessment based on >1 sampling event exceeds standards within a 3-year period. Assessed as impaired.

Escherichia coli: Single Sample Max

- **EPA Guidance**

    Implementation Guidance for Ambient Water Quality Criteria for Bacteria – Draft November 2003

    Wet Weather Exclusion from Standards
    – An intermittent site-specific standard could be established during defined periods of time due to storm water flows.
        - Requires a use attainablility analysis
            – Evaluate effects on recreation:
                ❖ Don't consider if high flows are attractive to recreation.
                ❖ Consider if wet weather flows result in dangerous conditions physically precluding recreation.
            – Determine if uses can be attained through effluent limitations

    – Need to communicate to public the conditions under which recreation should not occur.

Escherichia coli: Single Sample Max

- Discussions

  Wet Weather Exclusions from 303(d) Listing:
  - Decision to not list when exceedances are solely related to storm water flows could be made where enough supporting evidence that there is little risk of people getting into the water:
    - Wet weather flows result in dangerous conditions physically precluding recreation.
    - Not in or near a populated area.
    - Not in or near a popular swimming or recreation area.

  - Natural sources?
  - Might require revisions of standards.

Escherichia coli: Single Sample Max

- **Proposed Wet Weather Exclusion Criteria:**

  – ADEQ could make a case to <u>not list</u> a surface water as impaired where exceedances are associated only with storm flow conditions based on the following type of evidence:

    - Wet weather flows result in dangerous conditions physically precluding recreation (e.g., kayaking, swimming);
    - Not in or near a populated area;
    - Not a popular swimming area or recreational area; and
    - Regulated discharge not a potential source.

Escherichia coli: Single Sample Max

- Example Wet Weather Exclusion

Date	E. Coli (CFU)	Lab Note	Flow (CFS)
12/15/1999	14		0.9
03/02/2000	4		1.4
04/27/2000	40		0.5
08/23/2000	*57,000*		*115*
12/20/2001	2	K	2.3
03/03/2001	*1,800*		*104*
03/21/2002	2	K	1.9
09/17/2002	2		0.1
Exceedances occurred during storm water flows on 08/23/2000 and 03/03/2001. (K = less than)			

Escherichia coli: Single Sample Max

- Example Wet Weather Exclusion Decision

  – If site is on Little Colorado River near Woodruff,
    ADEQ can make a case to not list based on:

    - Storm flows were not attractive to recreation (e.g., kayakers).
    - Not in a populated area.
    - Not a popular swimming or recreational area.
    - No regulated discharges in the reach nor upstream.

Escherichia coli: Single Sample Max

- **Example Wet Weather Exclusion**

  - If on the Santa Cruz River near Tucson,
    ADEQ would make the listing because:

    - Site is near a populated area.
    - Unsure whether municipal stormwater flows or concentrated feed lots are contributing to exceedances. TMDL needed to establish loadings and whether additional bacterial management practices are needed.

Escherichia coli
Most Probable Number

- ## Working with a Most Probable Number
  - With bacterial samples, when the result is reported as 240 CFU, the result is between 100 to 940 CFU at a 95% confidence level.

Recommendation:

  - Use a screening value to account for this large margin of error in the results.

	Full Body Contact	Partial Body Contact
Standard	235 CFU	576 CFU
Screening Value	300 CFU	750 CFU
Screening value is 1.3 times the standard or 30% higher.		

Escherichia coli
Most Probable Number

- Proposal:

  – When applying single sample maximum standard, listings will be based on exceedances of the screening value.

  – If exceeding the standard, but not the screening value, assess as inconclusive.

Escherichia coli: Geometric Mean

- What time interval should be applied to the *E. coli* geometric mean standard when assessing water quality?

  – New surface water rules requires a minimum of four samples but does not set a time period.

  – The Impaired Water Identification Rule references a 30-day period (old surface water quality standard, subsequently replaced).

  – What is a valid time period? 30 days? Swimming season (May – Sept)? Five years of data?

Escherichia coli: Geometric Mean

- ## EPA Guidance

    Consolidated Assessment and Listing Methods (CALM) (2002)

    - Geometric mean should be based on 5 samples or more, equally spaced over a 30-day period.
    - Impaired if geometric mean is exceeded during recreational season.

    Note that impairment is based on 1 exceedance of a geometric mean, rather than >1 exceedances.

Escherichia coli: Geometric Mean

- ## EPA Guidance

  Implementation Guidance for Ambient Water Quality Criteria for Bacteria – Draft November 2003

    - Monitor primary swimming areas at least once a week during the swimming season

    - Geometric means may be calculated for specified periods of time (e.g., monthly, seasonal, or annual geometric mean).

    - Where insufficient samples to calculate a geometric mean, use the single sample maximum to assess.

Escherichia coli: Geometric Mean

- **Other states:**
  - Of 24 states
    - 6 - Do not apply a geometric mean standard for assessments.

  - Of 18 states applying a geometric mean standard
    - 11 – Calculated a monthly mean
      - ❖ Minimum varied from 2 – 5 samples per month)
    - 6 – Calculated a season mean (normally May – Sept)
      Minimum varied from 3 to 10 per season
    - 1 – Calculated a mean based on minimum of 3 samples in 60 day period

Majority of states apply monthly or seasonal geometric mean.

Escherichia coli: Geometric Mean

- Other states:

  - Of 18 states with a geometric mean standard

    - 17 based impairment on only 1 exceedance of a geometric mean

    - 1 based impairment on >1 exceedance of the geometric mean

      (Vermont's geometric mean standard is 18 CFU *E. coli* as compared to our standard of 126 CFU. Vermont intends to change its standard based on EPA criteria.)

Escherichia coli: Geometric Mean

- ## Recommendations:
  - Assessments will be based on <u>either</u> exceedances of a single sample maximum or a geometric mean.
    - If assessed as impaired due to exceedances of single sample maximum standards, geometric means will <u>not</u> be calculated.

  - Calculate the geometric mean in two ways:
    - If least 4 samples in a calendar month, calculate a monthly geometric mean.
    - If insufficient samples to calculate a monthly geometric mean, but at least 4 samples in a calendar year, calculate an annual geometric mean.

  - Impaired if either geometric mean calculation exceeds the standard <u>one</u> or more times.
  - Attaining if geometric mean standard is not exceeded.

Escherichia coli: Data Interpretation

- Data Interpretation for Geometric Mean Calculations

  - Existing:
    - When analytical result is reported as a "less than" value, use one-half of the value for descriptive statistics (e.g., geometric mean).
      - The result is 50% lower than lab detection limit.

  - Proposal:
    - When data is shown as "greater than" or "too numerous to count," multiply the upper laboratory detection limit by 1.5 for descriptive statistics.
      - The result is 50% higher than lab detection limit.

Escherichia coli: Data Interpretation

- Example: Data Interpretation for Geometric Mean Calculations

Geometric mean does not exceed standard of 126 CFU

Single sample maximum is much more likely to be reason for listing. Note in this example, geometric mean is not exceeded although 4 of 5 samples exceeded 126.

Escherichia coli Results		
Lab Result	Lab Note	Result Used In Calculation
132		132
2	K	1
220		220
159		159
2419	L	3628.5
Lab notes: L = greater than, K = less than		
Geometric mean = 101		

Escherichia coli: Summary

- **Proposal Summary**
  - Screening values for single sample maximum
    - Impaired based on exceedances of screening values
      - Full Body Contact = 300 CFU
      - Partial Body Contact = 750 CFU

Escherichia coli: Summary

- **Proposal Summary**
    - Single Sample Maximum assessments will vary based on:

        - If a large reservoir and distant sites, assess based on exceedances/site.

        - If small dataset – Use existing assessment criteria
            - Impaired if >1 sample exceeds screening value in 3 years.
            - Minimum of 2 sampling events exceed.

        - If large dataset (1 sample per week during swimming season) use binomial approach.
            - Impaired if >10% samples exceed screening value with a 95% confidence level.
            - Minimum of 3 sampling events exceed.

Escherichia coli: Summary

- **Proposal Summary:**
  - Wet weather listing exclusion – ADEQ could defend not listing a surface water, where bacterial exceedances are only associated with storm flow conditions, based on:

    - Wet weather flows result in dangerous conditions physically precluding recreation (e.g., kayaking, wading, swimming).
    - <u>Not</u> in or near a populated area.
    - <u>Not</u> a popular swimming area or recreational area.
    - Regulated discharges are <u>not</u> a potential source.

Escherichia coli: Summary

- **Proposals**
  - Geometric means
    - Assess if not already impaired based on single sample maximum
    - Impaired based on <u>one</u> exceedance of a geometric mean.
    - Calculate monthly geometric mean if at least 4 samples/month.
    - Calculate annual geometric mean, if insufficient samples to calculate monthly geometric mean, but at least 4 samples in a calendar year.
    - If analytical result is reported as "greater than" or "Too Numerous To Count," multiply result by 1.5 to determine geometric mean.